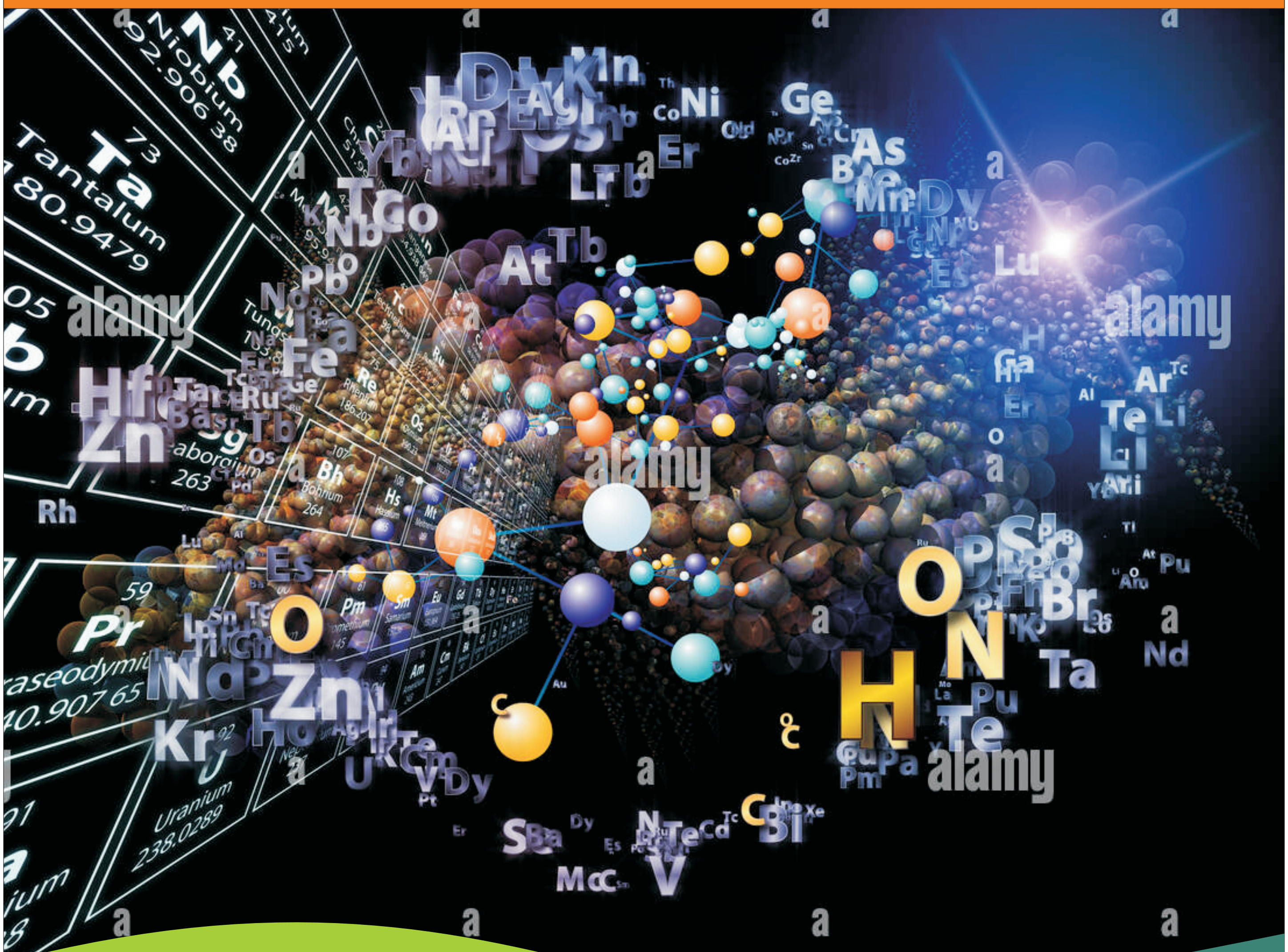
ASSOCIATION OF CHEMISTRY TEACHERS

NEWS LETTER

ISSUE : 26 MAY - AUGUST 2023



Promoting Excellence in Chemistry Education

Association of Chemistry Teachers

News Letter, May - August 2023

Contents of the News Letter : Issue - 26

From Editorial Desk

Prof. Wasudeo Gurnule
Editor
Kamla Nehru Mahavidyalaya,
Nagpur, Maharashtra.

We are happy to inform that the contributions of ACT ranges from International Olympiads, National and International Conferences, organizing seminars, science exhibitions, workshops, expert invited talks, innovating conceptual science experiments, talent search examinations, training faculty and students etc. We are bringing in the present issue of the newsletter with the reports on the ACT activities, trends in chemistry, views and news. We have included one scientific article in the present issue. We have also included reports on National Chemistry Events. We humbly request the entire fraternity of ACT to continue to contribute both in terms of their academic and individual achievements for the benefit of entire ACT Community

We invite good suggestions and better contributions from the readers to get best output of the future issues. We welcome you all to participate in the NCCT 2023.

With warm regards to one and all

Members of Editorial Board

Honorary Members of ACT

We have great pleasure in bringing the updated list of honorary members of Association of Chemistry Teachers, who are sources of inspiration, guidance and support in activities of ACT.

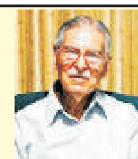
The editorial board of ACT News Letter is proud of the academic achievements of these legendary honorary members.

Bharat Ratna Prof. C.N.R. Rao, FRS
National Research Professor : Linus Pauling Research Professor,
Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bengaluru - 560 064
E-mail : cnrrao@jncasr.ac.in

Padma Vibhushan Prof. M.M. Sharma, FRS
Former Director, Institute of Chemical Technology, Mumbai - 440 019.
2/3, Jaswant Baug, V.N. Purav Marg, Chembur, Mumbai - 400 071
E-mail : profmmsharma@gmail.com

Padma Vibhushan Dr. R.A. Mashelkar, FRS
CSIR Bhatnagar Fellow;i Former Director General, CSIR, New Delhi.
President, Global Research Alliance, National Chemical Laboratory, Pune - 411 008.

Dr. Nitya Anand
Former Director, CSIR-Central Drug Research Institute, Lucknow.
B-62, Nirala Nagar, Lucknow - 226 020
E-mail : nityaanand1925@gmail.com



Prof. R.S. Mali
Former Vice-Chancellor, North Maharashtra University, Jalgaon.
B-2, Surajbun Housing Society, Aundh Road, Pune - 411 007.
E-mail : rsmali@rediffmail.com

Prof. S. Jayarama Reddy
Former Vice-Chancellor, S.V. University, Tirupati; Chancellor, SCSSV Mahavidyalaya, Kanchi
201, Ameya Towers, Street No. 12, Tarnaka, Hyderabad - 500 017.
E-mail : profsir@gmail.com

Padma Shri Prof. Jai P. Mittal
Former Director, Chemistry - Isotope Group, BARC, Mumbai - 400 085.
Chairman, Academic Board, UM-DAE Centre for Excellence in Basic Sciences,
University of Mumbai, Kalina, Mumbai - 400 098
E-mail : mittaljp2003@yahoo.co.in

Prof. Mihir K. Chaudhuri
Former Vice-Chancellor, Tezpur University, Tezpur.
Advisor, Education Department of Government of Assam, Gawahati - 781 006
E-mail : chaudhurimihirk@gmail.com; mkc@tezu.ernet.in

Padma Shri Prof. Dr. G. D.Yadav,
National Science Chair, SERB,New Delhi
Emeritus Professor of Eminence, Institute of Technology, Mumbai
Former Vice Chancellor, Institute of Technology, Mumbai
Email : gdyadav@gmail.com

Prof. Dr. A. K. Bakhshi
Chairman, National Resource Centre for Chemistry, MoE, GOI
Chairman, Guru Angad Dev Teaching Learning Centre for e-Learning,
SGTB Khalsa College, University of Delhi, Delhi
Founder Vice Chancellor, PDM University, Bahadurgarh, Haryana
Email : akbakhshi@yahoo.com

Reports of Activities of ACT

Report on Chemistry Workshop

Vikash Residential School, Kantabada, Odisha State.

An 'edu-discourse' two day **"Teacher Training Workshop"** was organized at **Vikash Residential School, Kantabada, Odisha State,** on **10th** and **11th June 2023**. This workshop was supported by Association of Chemistry Teachers (ACT, Mumbai). ***Dr. Mannam Krishnamurthy***, Secretary, South zone of ACT, coordinated the academics of the teacher training program on behalf of ACT.

Mr. G. BhaskarRao, Managing Director, Vikash Educational Institutions inaugurated the workshop by lightening the illuminated lamp and ***Mr. G. NageswaraRao,*** Executive Director of the group delivered inaugural address. 25 Chemistry junior lecturers, 30 postgraduate teachers and 10 administrative staff members from Bhubaneswar, Bargarh, Sambalpur, Bhavanipatna, Rourkela and Jharsuguda participated in the workshop.

Mr. G. Ananda Kumar, Lecturer, Varsity Education Management Ltd., Vijayawada delivered a talk on *'Micro academic schedules for macro benefits of teachers and students'*. ***Mr. D. Seshu Kumar,*** Dean, Narayana Group of Colleges, Bhubaneswar delivered another talk on *'Merits of interactive physical class room teaching and training'*.

Dr. M. Krishna Murthy, Chief Executive Dean, Varsity Education Management, Hyderabad conducted two sessions, one on first day and another on second day, on teacher training based on conceptual chemistry. ***Mr. U. LakshmanaSuri,*** Lecturer, Sri Chaitanya Junior College, Gosala conducted two sessions, one on first day and another on second day, on teacher training based on experimentation.

Two separate workshop sessions were also conducted by dividing junior lecturers into one group and PG teachers into another group, on both days by rotation, on Subjective versus Objective teaching orientations, question bank preparation, testing and evolution of academic merits. Participants and administrative staff interacted with the resource persons in the concluding session. ***Mr. A. Dileep Kumar,*** Academic Dean, Vikash Group of Institutions, Bhubaneswar delivered valedictory address. Assignment books, language of chemistry book and participation certificate from ACT was distributed to all participants. The workshop was ended with a cheerful note and all the teachers felt that the training was top rated and much useful.

Workshop session, training based on experimentation

Resource persons of the workshop (from L to R) Mr A Dileep Kumar, Kantabada, Mr D Seshu Kumar, Bhubaneswar, Mr G Ananda Kumar, Vijayawada, Dr Mannam Krishna Murthy, Hyderabad and Mr U LakshmanaSuri, Gosala.

Participants of the workshop with resource persons and administrative staff of the host institute, at the concluding session

Report on the Seminar

S.V.R.M. College, Nagaram, Bapatla Dist., A.P.

On the occasion of **World Environment Day 2023**, a one day seminar on **'Chemical Remedies on Plastic Pollution'** was organized at **S.V.R. Memorial College, Nagaram, Bapatla Dist., A.P.** This seminar was academically supported by Association of Chemistry Teachers (ACT, Mumbai) and academics were coordinated by **Dr. Mannam Krishna Murthy**, Secretary, ACT South Zone.

Dr. A. Hari Krishna, Principal of the host institute invited guests and deligates to the inaugural session. ***Mr. N. Prithvi Teja,*** Director, Rudraprayag Hydropower Ltd., & Rajanagaram Gas Power Ltd., graced the occasion as Chief guest. ***Mrs. Nanditha Prasad,*** Vice president of R.T. Education Improvement Society, Repalle and ***Mr. V.B. Chowdary,*** Secretary of SVRM College, Naragam were the other guests. They have briefed on the importance of Clean Environment. ***Dr. M. Krishna Murthy,*** Chief Executive Dean, Varsity Education Management Ltd., Hyderabad presented the Key-note address.

During the forenoon academic session, ***Dr. A. Koteswara Rao*** gave a talk on *'Monomers and Polymers'* and ***Dr. Ch.S.R.G. Kalyani*** a power point presentation on *'Global Plastic Pollution'*. During the afternoon academic session, ***Mr. R. Prasanna Babu*** gave a talk on *'Bio-degradable Polymers'* and ***Dr. K. Surendra Babu*** a power point presentation on *'Catalytic and Thermal Degradation of Plastics'*.

There were 19 female and 43 male lecturers from host institution and four nearby colleges participated as deligates. ***Mr. P. Venkata Narayana***, Vice-principal conducted an interactive session of the deligates and staff during the concluding session. The seminar topic is matching with the theme of WED-2023 and received well by the participants.

Dr. Mannam Krishna Murthy delivering the Key-note address. Guests, Mrs. Nandita Prasad, Mr N Prithvi Teja and Mr V. B. Chowdary were also present at the Inaugural Session.

Resource persons and Chemistry Faculty of Host Institute

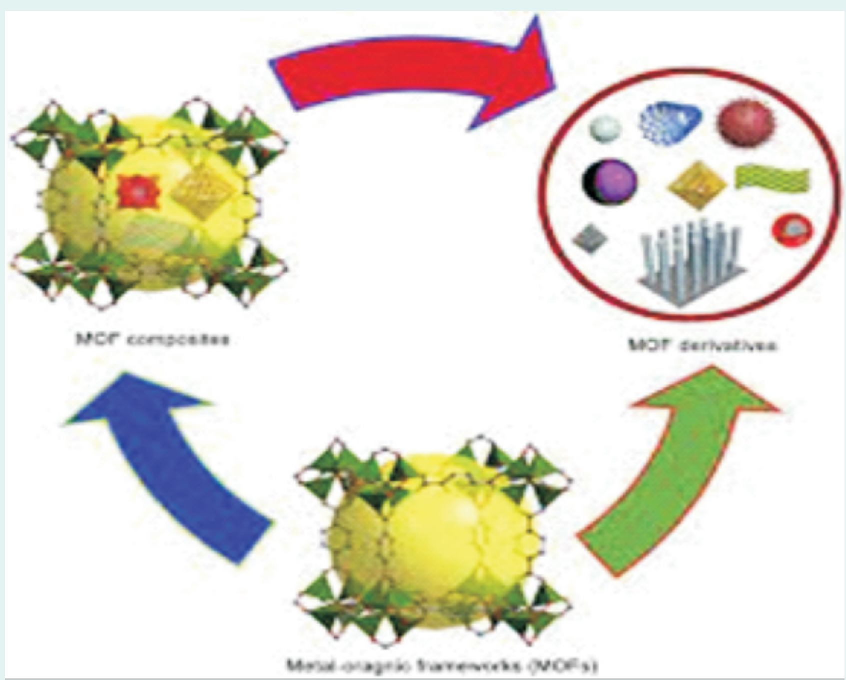
Delegates participated in the seminar.

Paramagnetic Metal-Organic Framework Composites and Their Applications

Dr. Rashmi Dubey
Department of Chemistry,
Kamla Nehru Mahavidyalaya,
Nagpur-440024

INTRODUCTION

MOFs are synthetic materials that emerged over the past three decades. They are comprising of organic ligands that bridge metal ions. This leads to highly ordered, porous and 3- dimensional crystalline structures. Paramagnetic metal organic frameworks are a class of material that contain both magnetic metal ions and organic ligands. These materials possess unpaired electrons that are localized on the metal ions, which makes them paramagnetic, they are attracted by an external magnetic field. The magnetic properties of these MOFs are unique and can be tuned by controlling the metal ions and ligand used in their synthesis. These materials have potential applications in the areas including sensing, catalysis and data storage. Recently, multifunctional MOFs have attracted much attention as they involve diverse characters in one material, for instance, combining porosity with magnetism.



Metal-Organic Framework *(MOF's)*

Nanocomposites are hybrid materials that combine two or more different types of materials at the nanoscale level. Often resulting in properties unique to the composite materials. Paramagnetic MOFs can be incorporated into nanocomposites with other materials, such as polymers or nanoparticles, to increases their magnetic properties and improve their performance in various applications. These nanocomposites exhibit different implementation in sewage water purification, storage of hydrogen, gas – energy storage, conversion of CO_2, luminescent materials ,biomedical imaging, solid phase extraction and antimicrobial agents. The metals used to make nanocomposites are chitosan, graphene, titanium, copper, gold, etc. The semi-conducting material also incorporated in the composites in order to acquire photocatalytic activity by electron-hole pair formation.

In addition to surface areas and porous nature, metal organic frameworks have storage mechanical strength and practically high thermal stability with considerable stability in harsh, toxic chemical atmosphere making them promising materials to meet the green chemistry standards.

SYNTHESIS

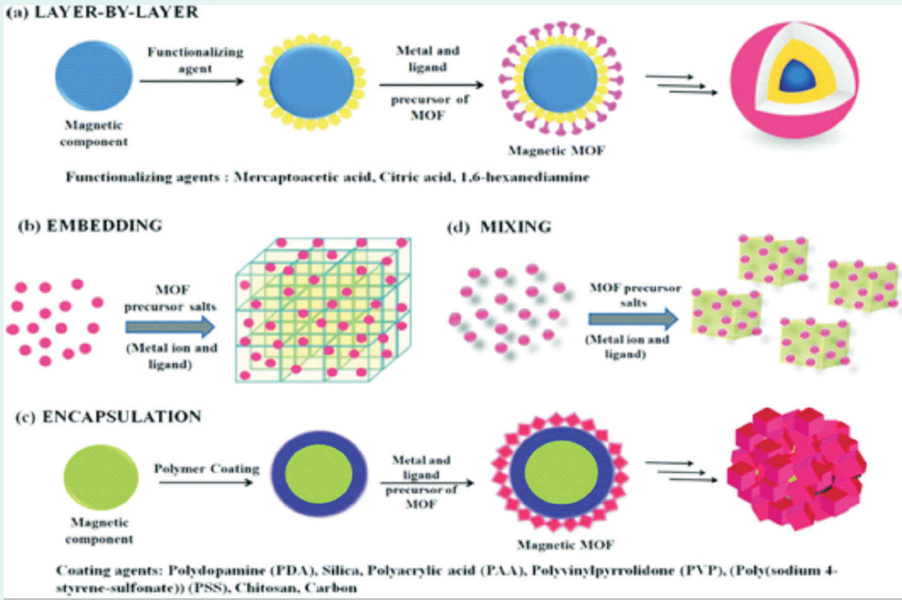
Sonochemical Method

Sonochemistry deals with the chemical transformations of molecules under high-energy ultrasonic radiation (20 kHz–10 MHz) high intensity ultrasound can be used for the novel materials and provides an unusual route to known materials without bulk high temperatures, high pressures. The bubbles formed when a reaction solution is irradiated with ultrasound radiation create local hot spots of a short life with a high temperature and pressure, promoting chemical reactions and the instantly formation of crystallization nuclei . High-quality crystals of MOF-5 and MOF-177 with a size of 5–25 μm and 5–20 μm, respectively, were prepared through the sonochemical method in the presence of 1-methyl-2-pyrrolidone as a solvent, in a substantially reduced reaction time.

Post-Synthetic Modification

The method involves the introduction of desired functional groups into the MOFs after their synthesis (PSM, Post Synthetic Modification) and is essentially a process of chemical transformation of the MOFs after their isolation.Post-synthetic modification reactions can create defects on the MOFs either by missing or re-placing metal nodes or by missing or partially replaced organic linkers. Such defects can be also generated during the conventional synthesis of MOFs and during the crystallization process and crystal growth The method has been widely used to prepare isostructural MOFs with different physical and chemical properties.

For example, IRMOF-3 containing 2-amino-1,4-benzenedicarboxylic acid can undergo chemical modification with a diverse series of anhydrides and isocyanates yielding isostructural MOFs containing different functional groups . replacement of the non-bridging ligands, and metal nodes. functionalizing the pores or nodes within the MOFs, affording or enhancing desired functional properties such as catalysis, selective gas adsorption, redox, and ionic conductivity. Mixed-metal MOFs, containing at least two metal Materials 2021, 14, 310 6 of 32 ions in their framework, can be prepared under post-synthetic methods, as well as from one-pot methods or by using metallo-ligands, and possess new properties and activities due to the presence of the second metal ion . Structural defects and inhomogeneities are often related to important material properties, and, hence, defect engineering has been effectively applied in order to modify and functionalize MOFs for applications in catalysis, gas sorption, separation and storage, and luminescent and magnetic materials.



Electrochemical Method

Technique that has been widely used for the synthesis of metal nanoparticles. The method is used for the synthesis of MOF powders on an industrial scale. Electrochemical deposition occur at the interface of an electrolyte solution containing the metal to be deposited and an electrically conductive metal substrate.

The metal ion is provided by anodic dissolution into reaction mixtures that contain the organic ligands and electrolytes. The major advantages of this method are the slighter temperatures of reaction and extremely quick synthesis under milder conditions, compared to solvothermal method. Several MOFs, such as HKUST-1, ZIF-8, MIL-100(Al), MIL-53(Al), and NH2-MIL-53(Al), and the influence of several reaction parameters on their yield and texture properties have been investigated. Various nanostructures such as nanorods, nanowires, nanotubes, nanosheet , dendritic nanostructures with paramagnetic properties would be developed.

Slow Evaporation and Diffusion Methods

During the slow evaporation method, solutions of the reagents are mixed and left for slow evaporation and crystals are formed when a critical concentration is reached, to favour nucleation and crystal growth. The Compound can be dissolved in a single solvent or mixture of two solvents and left for slow evaporation. Mixtures of low boiling point solvents are often used to accelerate the process.

During the diffusion method, solutions of the reagents are placed one on the top of the other, separated by a layer of solvent, or are gradually diffused by diving physical barriers. In some cases, gels are used as crystallization and diffusion media. Crystals are formed in the interface between the layers, after the gradual diffusion of the precipitate solvent into the separate layer.

For Example; $Fe_3(TFBDC)_3.(H_2O)_3.(DMF)_3$

The diffusion technique is used specifically if the products are not very soluble. MOF-5 or IRMOF-with formula $[Zn4O(BDC)_3]$ ·(dmf)8(C6H5Cl)] n (BDC_2- = 1,4-benzodicarboxylate) was prepared by diffusion of Et3N into a solution of $Zn(NO_3)_2$ and H2BDC in chlorobenzene and addition of a small amount of hydrogen peroxide to facilitate the formation of O_2- bind to the centerof the SBU.

Characterization

- MOFs microporous materials have large internal surface area and tuneable cavities. These characteristics are useful for the purposes of gas storage, chemical separation, catalysis, drug delivery and sensing.
- Nanocomposites are potential hybrid materials containing matrix and nanofillers which possess unique characteristics.
- Paramagnetic metal-organic framework nanocomposites can be developed by the encapsulation of magnetic materials into the MOFs. Due to this it does not affect the Magnetic properties and remains unchanged.
- The MOFs were characterized by infrared spectrometry, X-ray diffraction, scanning electron microscopy, and thermogravimetry. They were investigated for use as adsorbents for the adsorption of Congo red (CR) from aqueous solutions.
- MOFs are porous solid with promising properties such as; up to 5900 m2/g surface areas, pores < 2 nm, up to 2 cm3/g pore volume, and 0.4 g/cm3density.
- The MOF-199 ,copper based microporous composed of dimeric Cu units bridged is considered one of important MOFs since it has a high pore volume, good stability upon water adsorption, large surface area, and high chemical stability.
- MOFs are produced in Powder state, as they precipitate from a reaction in a solvent. The physical form must remain reproducible and stable. Therefore the powder size must remain unchanged.
- The MOFs were characterized by infrared spectrometry, X-ray diffraction, scanning electron microscopy, and thermogravimetry. They were investigated for use as adsorbents for the adsorption of Congo red (CR) from aqueous solutions.
- Monitoring the elemental concentration of a MOF's carrier liquid can help and used to study that the MOF harvests and releases ions prominently.
- Different characterization techniques play a important role in structural, physical characterization to study the interactions of MOFs with other materials.

Field emission scanning electron microscopy with energy dispersive X-rays (FESEM-EDX), Thermogravimetry analysis (TGA), Dynamic light scattering (DLS), X-ray diffraction analysis (XRD), and Fourier transform infrared spectroscopy (FTIR) characterization techniques are used to analyze the surface morphology, thermal stability, particle size range distribution, crystal structure and crystallinity, and chemical composition, respectively, of the MOFs.

Catalysis Applications

The most important features of MOFs is its potential for catalytic activities. The catalytic properties of MOFs can come directly from their hybrid structure or can be induced by the incorporation of catalytically active but unstable nanoparticles. The periodic structure of MOFs allows the active sites to be dispersed uniformly throughout the framework while the pores and channel of the framework facilitate the accessibility of active sites and the transport of substrates and products. Moreover, the specific pore size and shape of MOFs perform as shape-selective catalysts.MOFs have been utilized as heterogeneous catalysts, photocatalysts, and electrocatalysts by many researchers. They are mostly used as heterogeneous catalysts in well-known organic reactions.

The semiconductor-like behavior of MOFs makes them potential photocatalysts. Photocatalytic properties of MOFs are exploited in organic pollutant degradation, various organic reactions, hydrogen/oxygen production from water splitting, and reduction of CO_2.Once the poor conductivity of MOFs is compensated by the addition of nanomaterials they show excellent electrocatalytic properties due to their high surface area and pore volume. Electrocatalytic applications of MOFs mainly focus on the oxygen reduction reaction (ORR), oxygen evolution reaction (OER), hydrogen evolution reaction (HER), and carbon dioxide reduction.

Sensors

Structure of MOFs and their composites have been exploited in chemical sensors. MOFs generally shows a luminescent behavior upon the inclusion of a guest molecule. This unique function comes in handy for sensor applications. Furthermore, the physical and chemical structure of MOFs can be manipulated to selectively respond to desired molecules and their active sites on a high surface area lead to a highly sensitive sensor application. ZIF and UiO MOF groups have been the focus of these sensor applications. MOFs are used for the sensing of biomolecules, metal ions, explosives, environmental toxins, and humidity.

Biomedicine

Expanding area in science is biomedicinal applications. As technology improves the search for **effective and targeted drug delivery systems** has become more and more plausible. Different approaches have been taken on the subject to obtain better systems. The unique structural diversity of MOFs makes them an excellent platform for biomedicinal applications. In contrast to conventional nanomedicines, MOFs show biodegradability and high loading capacity. Their high surface area, large pores, and chemical properties are suitable for novel drug delivery systems and controlled release of compounds. Promising applications have been investigated on different drugs such as ibuprofen, procainamide, and anticancer treatments.

'AI' TOOLS FOR TEACHING AND RESEARCH IN CHEMISTRY

Dr. Bibhuti Narayan Biswal, Academic Lead
Reliance Foundation Schools Academic Council (RFSAC),
Reliance Corporate Park, Navi Mumbai -400701, Email: Bibhuti.nb@gmail.com

Chemistry is a complex and dynamic field that necessitates a profound understanding of fundamental concepts and principles especially to associate real-life circumstances with abstract chemistry concepts. This urges for effective chemistry content contextualization by teachers. Teaching chemistry has evolved in multiple ways after the integration of Artificial Intelligence (AI) into context. The obvious questions for teachers to understand are 'How does Artificial Intelligence affect teaching chemistry?' and 'How does teaching chemistry with Artificial Intelligence accelerate the depth of understanding of concepts? Recent research has found that found that AI-powered teaching chemistry approach to teaching chemistry concepts enabled students to become grossly involved in the subject and enhanced student interest in the engagements with chemistry.

For instance, using machine learning algorithms the prediction of molecular properties such as bioactivity, toxicity, solubility, melting points, atomization energies, designing the new molecules, retrosynthesis, reaction conditions predictions, reaction optimization, and reaction outcomes predictions, HOMO/LUMO molecular orbital energies and many other kinds of properties, etc. can be done within seconds. Even today, Augmented Reality is booming, with huge potential to revolutionize learning in many areas as it responds to the curiosity of children, and students, and develops logic to learn chemistry in an interactive way. Therefore, it is pertinent to relook at the teaching of chemistry and research through the lens of AI which is given below in Figure 1.

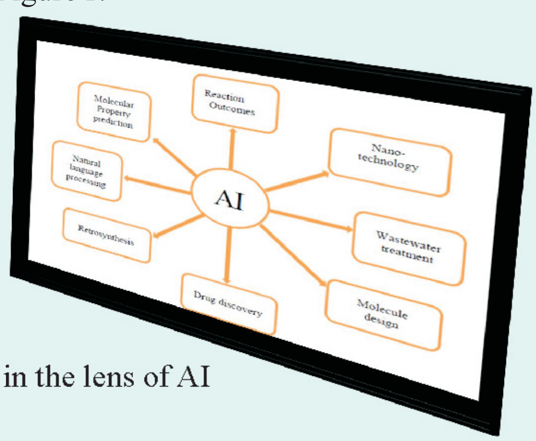


Figure 1:Chemistry in the lens of AI

Following are the AI tools that can be used by chemistry teachers to accelerate students' engagement with chemistry.

1. Elements 4D: Elements 4D provides an innovative way to learn real-life chemistry as it has the capability to illustrate various chemical elements and the reactions they have using Augmented Reality. This app is designed to inspire and engage students about science and chemistry in an interactive way. In addition, the app allows the user to view substances and information about them, through using cubes. Moreover, it is possible to combine several elements and view the result of the combination. The substances are in their natural state, liquid,

solid, or gaseous. Professors can use this app to demonstrate toxic chemical combinations and the results in a safe and controlled environment using the Elements 4D augmented reality.

2. Generative AI Bots (GenAI Bots) & ChatGPT Plugins

- ? Show Me plugin: Showme is helpful for data visualization in Chat GPT through the Diagrams: It also gives tips, ideas, and a range of options for creating diagrams that are essential for teaching complex concepts and illustrating the same in research papers.
- ? GenAIbots: They serve as agents to think with, and highlight several powerful pedagogical strategies that can facilitate a profound comprehension of the involved concepts. It involves positive reinforcement, as GenAIbots acknowledges students' observations, validates their experiences, and stimulates their curiosity. GenAIbots offers relevant explanations, examples, and analogies to support their learning, adapting responses to the students' questions and confusions, providing customized explanations, thereby promoting active learning, and personalized instruction.
- ? GPT Prompts: Generative pre-trained transformer(GPT) a natural language generation model that can learn and fine-tune outputs based on labeled prompt data, and ranking of responses. Prompts can be used for exploring various applications for teaching learning of chemistry. For example:
- ? Lab Idea Prompt: What are some lab ideas for high school chemistry on the topic of colligative properties?
- ? Lesson plan prompt: Write a 75-minute lesson plan for 1st year UG chemistry on the topic of electrons and light. Include a demonstration that shows light of different color have different energy. Include another demonstration that shows the flame tests of metal ions.
- ? Generating Lab Procedure Prompt: Can you provide an experimental procedure for students to conduct a lab on freezing point depression?
- ? Correct explanation Prompt: Provide three different explanations for the difference between evaporation and boiling. One explanation should be correct and the other two should be incorrect yet very convincing.
- ? Exam. Review prompt: Create three exam review questions for converting the mole.
- ? Metal Organic Framework Prompt: Which metal is used in the synthesis of MOF-5 & MOF-519?

Conclusion

In India, the concept of AI has not been explored much in teaching, learning & research to date. AI-powered chemistry may ultimately transcend the limits of human cognition. AI can perform the work we are doing by spending hours and days in minutes and seconds. Therefore, a quantum leap is needed for the integration of AI-powered tools to revolutionalise our chemistry teaching & research whose time has come for which chemistry faculty members have to take the lead.

References:

1. Macariua,C., Iftenea,A., Gîfua,D. (2020)Learn Chemistry with Augmented Reality Procedia Computer Science, 176 (2020) 2133–2142Retrieved from https://www.sciencedirect.com/science/article/pii/S1877050920321542

2. Bharti, R., Choudhary, N.,Sharma,R.(2021)Role of artificial intelligence in chemistry, Materials Today Proceedings, Volume48,Part 5, 2022, Pages 1527-1533 Retrieved from https://www.sciencedirect.com/science/article/pii/S2214785321063446

■■■

Academic Participation of ACT Members

1. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, delivered a Talk on "Improved Electrical Properties of Copolymer Derived from 2-Amino 6-nitrobenzothiazole and Dithiooxamide with Formaldehyde and Its Composite with Activated Charcoal" in International Conference on Advanced Futuristic Materials for Sustainable Society (ICAFM-2023) organized by Chandigarh School of Business,Jhanjeri, Mohali on 22nd August 2023.
2. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on " Mechanical and Thermal Staibility of Styere- Butadiene Rubber in presence of Nano Clay" in 6th International Conference on Clean Energy and Technology (CEAT-2023) organized by Univeristy of Malaya, Malaysia, 7-8 June 2023.
3. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on "Nanomaterials and Nanotechnogy" in the International Conference on Multidisciplinary Innovative Research and Development 2023(ICMIRD-2023), organized by Sidvi Foundation and Nilkanthrao Shinde Science and Arts College, Bhadravati, 1-2 July 2023.
4. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Keynote Address on " Nanomaterials and Its Applications to the Mankind", in the International Conference on Latest Trends in Applied Science, Management, Humanitities and Information Technology, organized by IQAC, Sai College, Sector 6, Bhilai, India, 26-27 May 2023.
5. **Prof. Wasudeo Gurnule**, Secretary of ACT West Zone, Delivered Invited Talk on " SBR Rubber and its Applications", in the National Conference on Futuristic Materials (NCFM-2023), organized by Department of Chemistry, Govt. V. Y. T. PG Autonomous College, Durg (Chhattisgarh) India, 23 June 2023.

Doubly oxidisedcarbene tests the limits of the octet rule

An unprecedented four-electron carbon intermediate has been isolated and characterised by researchers in the US. The team used a two-step approach to remove the non-bonding electrons from a stable carbene intermediate to create a crystalline doubly oxidisedcarbene.

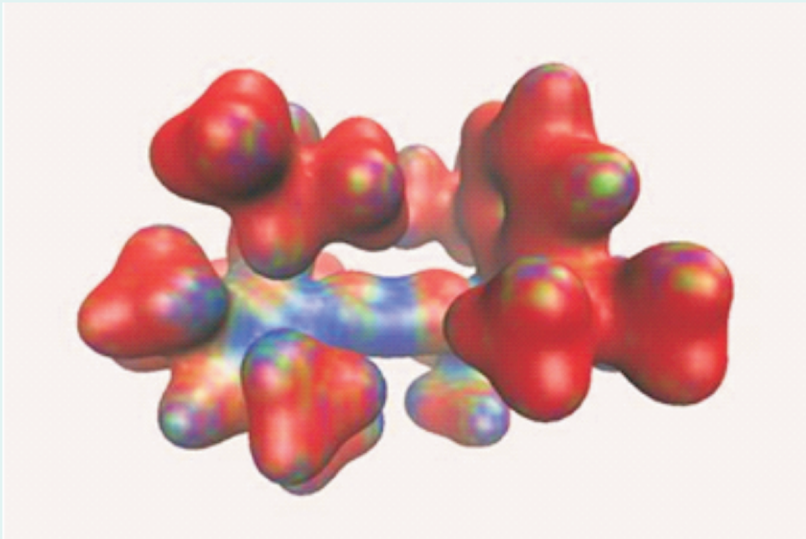
Carbenes were first discovered at the beginning of the 20th century but their extreme reactivity made them difficult to handle and they were widely dismissed as a laboratory curiosity. These reactive species contain an unusual six-electron carbon atom, bonded to two substituents and with two non-bonding electrons on the carbon centre. Careful choice of the bonded groups can stabilise this electron-deficient carbon and over the last 30 years carbenes have become a powerful tool in synthesis.

Now, Guy Bertrand and Ying Kai Loh at the University of California San Diego, US have pushed the octet rule of main group elements – that atoms bonded to one another tend to have eight electrons in their valence shell – even further, removing the two non-bonding electrons to prepare a highly-reactive four-electron carbon species. The team began with a bis(imino)carbene whose two electron-donating substituents stabilise the vacant orbital on the central six-valent carbon. However, they quickly encountered problems using single-electron oxidation conditions.

The initial oxidation produces an unstable five-electron carbene radical cation which immediately abstracts a hydrogen radical from the reaction solvent to form an unwanted side product. 'We therefore employed a two-step approach,' explains Loh. 'First, oxidation of the carbene to a carbonyl compound, then, oxide-ion abstraction which removes the oxygen atom along with two electrons to afford the doubly oxidisedcarbene. This approach bypasses the generation of that highly reactive carbene radical cation.

The resulting crystalline dication contains just four valence electrons, but the team's careful choice of bulky electron-rich substituents protects the electron-deficient carbon centre from quenching by the crystal counterions while simultaneously stabilising the double positive charge. 'The authors cleverly used imine functional groups to assist in this stabilisation,' explains Todd Hudnall, a main group chemist at Texas State University in the US. 'The two flanking nitrogen atoms are electron rich and feature lone pairs of electrons that are capable of stabilising the formal C^{2+} centre through resonance effects. In such a way, the 2+ charge can be distributed throughout the N–C=N–C–N=C–N linkage.'

Even with this stabilisation, the doubly oxidisedcarbene is potently electrophilic, reacting via the central carbon as both a Lewis acid and an anion abstractor. Intriguingly, the team also identified reduction conditions to convert the dication back to the parent carbene, making the interconversion of these species a unique, reversible two-electron redox system.

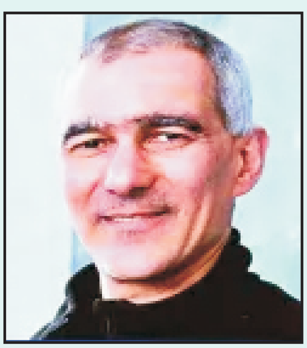


Electostatic Potential map of the doubly oxidisecarbene

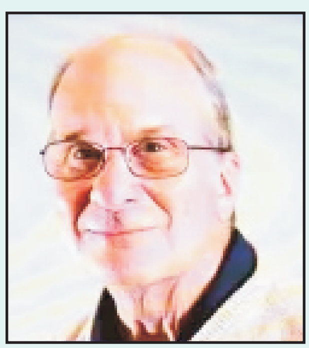
Bertrand is confident that this new reactive species will ultimately find many uses throughout the chemical and material sciences and hopes that others will begin to explore the potential of these carbenes. 'This work is fundamental in nature but it paves the way for the isolation of a variety of doubly oxidisedcarbenes,' he says. 'In the short term, we need to demonstrate that this compound is not unique and many dications could be stable with simpler substituents. In the future other applications may arise and I have no doubt that we or others will find them.'

This discovery has already met with excitement and Hudnall is particularly eager to see how this work will influence future catalytic strategies. 'Given the highly delocalised nature of the 2+ charge in the molecule, it would be interesting to see if this dication can be used to activate small molecule substrates relevant to the renewable energy arena such as carbon monoxide, carbon dioxide or hydrogen,' he says.

The Nobel Prize in Chemistry 2023



Moungi Bawendi
Massachusetts Institute of Technology (MIT), USA



Louis Brus
Columbia University USA

Alexei Ekimov
Nanocrystals Technology Inc. USA

Moungi G. Bawendi, Louis E. Brus and Aleksey Yekimov are awarded the Nobel Prize in Chemistry 2023 for the discovery and development of quantum dots. These tiny particles have unique properties and now spread their light from television screens and LED lamps.*They catalyse chemical reactions and their clear light can illuminate tumour tissue for a surgeon.*

Size matters on the nanoscale

In the nanoworld, things really do behave differently. Once the size of matter starts to be measured in millionths of a millimetre, strange phenomena start to occur – *quantum effects* – that challenge our intuition. The 2023 Nobel Laureates in Chemistry have all been pioneers in the exploration of the nanoworld. In the early 1980s, Louis Brus and Aleksey Yekimov succeeded in creating – independently of each other – quantum dots, which are nanoparticles so tiny that quantum effects determine their characteristics. In 1993, MoungiBawendirevolutionised the methods for manufacturing quantum dots, making their quality extremely high – a vital prerequisite for their use in today's nanotechnology.

Thanks to the work of the laureates, humanity is now able to utilise some of the peculiar properties of the nanoworld. Quantum dots are now found in commercial products and used across many scientific disciplines, from physics and chemistry to medicine – but we are getting ahead of ourselves. Let's uncover the background to the Nobel Prize in Chemistry 2023.

Few people thought quantum effects could be utilised

Still, in the 1970s, researchers did succeed in making such a nanostructure. Using a type of molecular beam, they created a nano-thin layer of coating material on top of a bulk material. Once the assembly was complete, they were able to show that the coating's optical properties varied depending on how thin it was, an observation that matched the predictions of quantum mechanics.

This was a major breakthrough, but the experiment required very advanced technology. Researchers needed both an ultra-high vacuum and temperatures close to absolute zero, so few people expected that quantum mechanical phenomena would be put to practical use. However, now and again science offers up the unexpected and, this time, the turning point was due to studies of an ancient invention: coloured glass.

This was the first time someone had succeeded in deliberately producing quantum dots – nanoparticles that cause size-dependent quantum effects. In 1981, Yekimov published his discovery in a Soviet scientific journal, but this was difficult for researchers on the other side of the Iron Curtain to access. Therefore, this year's next Nobel Prize Laureate in Chemistry – Louis Brus – was unaware of Aleksey Yekimov's discovery when, in 1983, he was the first researcher in the world to discover size-dependent quantum effects in particles floating freely in a solution.

List of ACT Life Members During May' 2023 to August' 2023

Sr. No.	Names	LM No.	Institution
1	Mustazi Jafri	2530	Goverment College, Sanwer, Dist. Indore (M.P.)
2	Juzer Ali Rangwala	2531	Govt. College, Kannod, Dewas, M.P. - 455332
3	T. Brindha	2532	Karpagam Academy of Higher Education, Pollachi Main Road, Eachanari, Coimbatore - 641 021
4	S. Hemalatha	2533	Department of Science and Humanities, Faculty of Engineering, Karpagam, Academy of Higher Education, Coimbatore - 641 021
5	Sruthi S.	2534	Karpagam Academy of Higher Education, Pollachi Main Road, Eachanari Post - Coimbatore - 641 021
6	A. S. Ganeshraja	2535	Department of Chemistry, SRM Institute of Science and Technology, Ramapuram, Chennai - 600 089
7	Kailas Ashok More	2536	At - Nabira Mahavidyalaya, Katol, Dhantoli, Tal - Katol, Dist.- Nagpur - 441 302
8	Dr. Sanyogita Shahi	2537	Kalinga University, Raipur, Chhattisgarh - 492101
9	C. Jayashree	2538	Department of Chemistry, SRM Institute of Science and Technology, Ramapuram, Chennai - 600089
10	S. Vasthi Gnana Rani	2539	Department of Chemistry, SRMIST, Ramapuram, Chennai - 60.0 089
11	Dr. P Jeyaraman	2540	Department of Chemistry, SRMIST, Ramapuram, Chennai - 60.0 089
12	Shambhu Nath Chatterjee	2541	Asansol North Point School, NH-2 Chanda More, Asansol, West Bengal- 713339
13	Sushree Nayak	2542	Vikash Residential School Deras Road, Bhagabatipur, Kantabada, Bhubaneswar Odisha -752054
14	Ravindra Nath Velagada	2543	Vikash The Concept School, Barabhuja Knowledge Park, Bhubaneshwar - Odisha - 751 030
15	Samarendra Nath Panda	2544	Vikash Enclave, Near Vikash Hospital, Barahaguda Canal Chowk, Bargarh, Odisha - 768 040

List of ACT Life Members During May' 2023 to August' 2023

Sr. No.	Names	LM No.	Institution
16	Arati Mishra	2545	Vikash Enclave, Near Vikash Hospital, Barahaguda Canal Chowk, Bargarh, Odisha - 768 040
17	Alapati Dileep Kumar	2546	Vikash Residential School, Kandhobandhopala, Odisha - 766 003
18	Visweswara Rao Balaga	2547	Vikash Residential School, Kantabada, Deras Road Bhubaneswar, Odisha - 752 054
19	Anisetty Peddiraju	2548	Vikash High Global Campus, Kantabada, Khurda Road, Bhubaneswar, Odisha - 752 052
20	Atindra D. Shukla	2549	Vikash High Global Campus, Kantabada, Khurda, Bhubaneswar, Odisha - 752 052
21	Shraddha Bais	2550	Department of Chemical University - 387 002
22	Preeti Soni	2551	ISR, IPS Academy, Rajendra Nagar, AB Road, Indore - 452 012
23	Sathish C G	2552	Govt. G.N.A. P/G College, Bhatapara, Dist. Balodabazar-Bhatapara(C.G.), Raipur, Chattisgarh - 493 118
24	Prakashbhai Vikrambhai Bishnoi	2553	G7, Olympiad building, Homi Bhabha Centre for Science Education Mankhurd, V N Purav Marg, Mumbai - 400 088
25	Nihalkumar Pravinbhai Patel	2554	Ganpat University Khera, Mehsana, Gujrat - 384012
26	Krunal M Modi	2555	Department of Chemistry, MUT, Ganpat University, Dist.-Mehsana - Gujrat - 384012
27	Madhuri J. Suthar	2556	Indrashil University, Gujarat-382740
28	Mansi Panchal	2557	Ganpat Vidyanagar, Mehsana, Gozaria Highway, Kherva, Gujarat 384012
29	Jayminkumar Hemantbhai Parikh	2558	Department of Chemistry, Ganpat University, Gozaria Highway, Kherva, Gujarat 384012
30	Prasanta Das	2559	85, Gopal Nagar Society, Parvat Patiya, Surat, Gujarat - 395010

List of ACT Life Members During May' 2023 to August' 2023

Sr. No.	Names	LM No.	Institution
31	Madhuresh Kishorkumar Makuvana	2560	Department of Chemistry, MUIS, Ganpat University, Kherva, Gujarat 384012
32	Devdatt Jayeshbhai Patel	2561	Department of Chemistry, Ganpat University, Kherva, Mehsana, Gujarat - 384012
33	Dr. Jayant Gowda	2562	Department of Chemistry, MUIS, Ganpat University, Kherva, Gujrat - 384012
34	Dilip Shankar Avte	2563	Department of Chemistry, BLDEAs Degree Science College, Jamkhandi, Bagalkot, Karnataka - 587301
35	P. Muthukrishnan	2564	Chemistry Dept., Padmashri Vikhe Patil College of Arts, Science & Commerce, Pravaranagar,Tal- Rahata, Dist.-Ahmednagar - 413713
36	Ketepalli Prasad	2565	Faculty of Engineering, Karpagam Academy of Highter Education Eachaneri, Coimbatore, Tamilnadu - 641021
37	Deependra Kumar Sharma	2566	Govt. College, Garoth Distt. Mandsaur (M.P.) 458880
38	Amit Shrivastava	2567	Govt. College, Gairatganj, District Raisen, Madhya Pradesh, 464884
39	Satyam Naidu Kandi	2568	Raghu Engineering College, Vishakhapatnam, Andhra Pradesh - 531162
40	Rama Rajeswari Makena	2569	Dept. of Chemistry, GVP College of Engineering (Autonomos), Madhurawada Visakhapatnam - 530048
41	Priyadarshini Gehlot	2570	Sant Singaji Govt. College Mundi Khandwa, (M.P.) - 450112

L.M./IM No.:______________________ Receipt No.___________________

ASSOCIATION OF CHEMISTRY TEACHERS (ACT)

Homi Bhabha Centre for Science Education
Tata Institute of Fundamental Research
103, NIUS Bldg.,V.N. Purav Marg,Mankhurd, Mumbai-400 088.
(Regd.No. Maharashtra Government, Mumbai 922,2010 G.B.B.S.D. dated 08/04/2010)
Website:www.associationofchemistryteachers.org

Date:______________________

To,
The General Secretary,
Association of Chemistry Teachers,
HBCSE(TIFR), Mumbai-400 088.

Dear Sir,

I/We wish to take the Life/Institutional Membership of A.C.T.
[Fees: Life Rs.1500/- and Institutional (one time payment) Rs.15,000/-]
A cheque/Demand Draft No.________________________ dated _________________ of Rs._________ drawn on _______________________________Bank, payable at par at Mumbai, in favour of "Association of Chemistry Teachers" is enclosed.(Outstation members should remit through demand draft only.)

1. Name :____
2. Membership Sought : Life/Institutional
3. Qualifications :____
4. Designation :____
5. Date of Birth :____
6. **Office address** :____

 ____ PIN:

Telephone : Fax: Email:

7. **Residential address** :____

 ____ PIN:

Mobile: Landline: Email:

8. Area of teaching/research interest:____

 ____

 I am aware of the objective, rules and regulations of ACT and shall abide by them.

Place______________________ Yours sincerely,
Date:______________________

(Signature)

All correspondence should be made to the General Secretary, Association of Chemistry Teachers, 103, NIUS Bldg., Homi Bhabha Centre for Science Education (TIFR), V.N. Purav Marg,Mumbai -400 088.

FOR OFFICE USE ONLY

ACT Membership awarded: Life/Institutional
Received from____ a sum of Rs.___________________
by Cash/cheque/DD no.___________________dated_________________ drawn on ___________________
Bank being the ____________________membership fees of ACT.
Membership No.:_____________________

General Secretary Treasurer

ACT ACT

ASSOCIATION OF CHEMISTRY TEACHERS

(Promoting Excellence in Chemistry Education)
Homi Bhabha Centre for Science Education (HBCSE, TIFR)
V.N. Purav Marg, Mankhurd, Mumbai - 400 088

www.associationofchemistryteachers.org

ACT NEWS LETTER

ISSUE - 26 MAY - AUGUST 2023